Relative Risk of Workload Transitions In Positive Train Control

Overview of Objectives and Approach

Presentation to PTC Working Group Meeting
Nashville TN
October 22, 2002

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Background to the Study

FRA is concerned about the safety implications of workload transitions in Positive Train Control (PTC) system operations.

- After sudden loss of one or more PTC functions.
- When a PTC system acts in an unexpected manner.
- When operating staff have to operate with equipped and unequipped trains and/or PTC and non-PTC territory in their daily work.
- In the start-up period of a PTC installation.

This study is one of a number of efforts by FRA in the general area of PTC safety assurance.

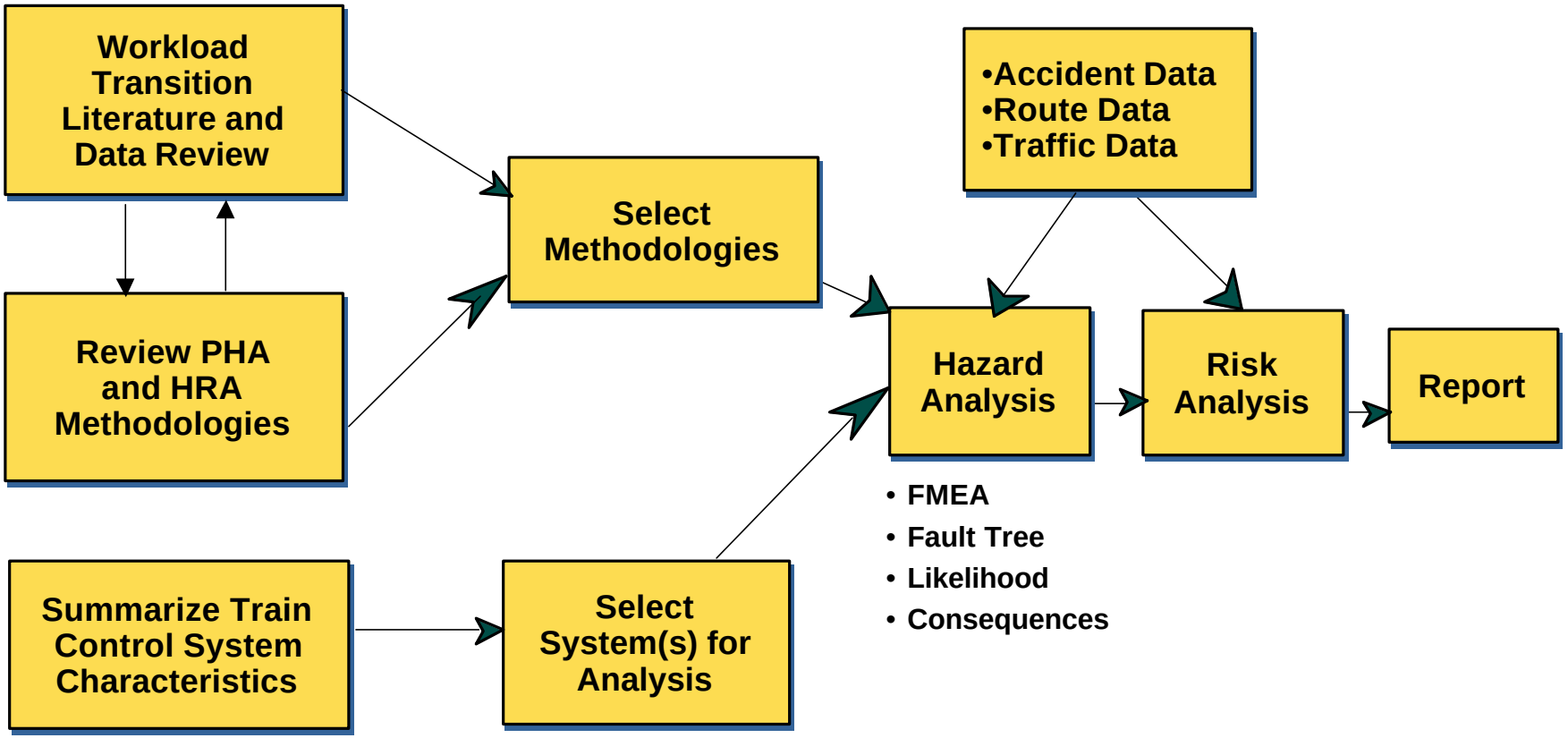
Objectives of the Study

The primary objective of the study is to understand the potential effect of workload transitions on PTC safety performance

- Review and summarize current research on workload transitions (Task 1).
- Select one or two representative PTC systems for a risk analysis (Task 2).
- Review and select human reliability analysis and probabilistic risk analysis methods for application to the PTC systems (Task 3)
- Perform risk analyses of the selected PTC systems to illustrate the relative risk associated with workload transitions (Task 4).

Work Plan – Overview

The flow diagram illustrates the relationships between the different tasks in the study.



Work Plan – Workload Transitions (Task 1)

The review of literature and data on workload transitions will focus on situations relevant to railroad engineers and dispatchers.

- Selective review of literature, focusing on workload transition situations analogous to railroad operation.
- Maintain close interaction with task on HRA techniques.
- Prepare interim report documenting results of the task.

Work Plan – Identify PTC Systems (Task 2)

Several PTC or high performance train control systems are candidates for the detailed risk analysis.

- Northeast corridor enhanced ATC system with ACSES.
- CSX's CBTM system for dark territory.
- Amtrak ITCS installed in Michigan (CTC overlay).
- NAJ PTC project in Illinois (AAR/IDOT/FRA).

These and other identified systems will be characterized, followed by selection of one or two systems (and their application to a specific rail corridor) for detailed analysis, in consultation with FRA.

Work Plan – HRA Methods (Task 3)

Applicable Human Reliability Analysis (HRA) methods will be examined in this task, leading to selection of techniques to be applied in risk modeling.

- Review available methods for suitability for this analysis, focusing on current developments not yet reflected in the literature.
- Summarize data requirements, working interactively with the workload transition task (task 1).
- Select methods for application in the full risk analyses.

Work Plan – Analysis of PTC Systems (Task 4)

The risk analysis of selected PTC system(s) brings together the results of prior tasks.

- Identify hazards of each PTC system, incorporating workload transition information from Task 1, and using FMEA, fault tree analysis, etc. as required.
- Characterize each hazard: (frequency, conditional probability, severity) incorporating HRA results from Task 3.
- Characterize the rail corridor to which the PTC system is being applied – baseline accident rates, traffic density, speeds, etc.
- Prepare spread-sheet models and perform the risk analyses.

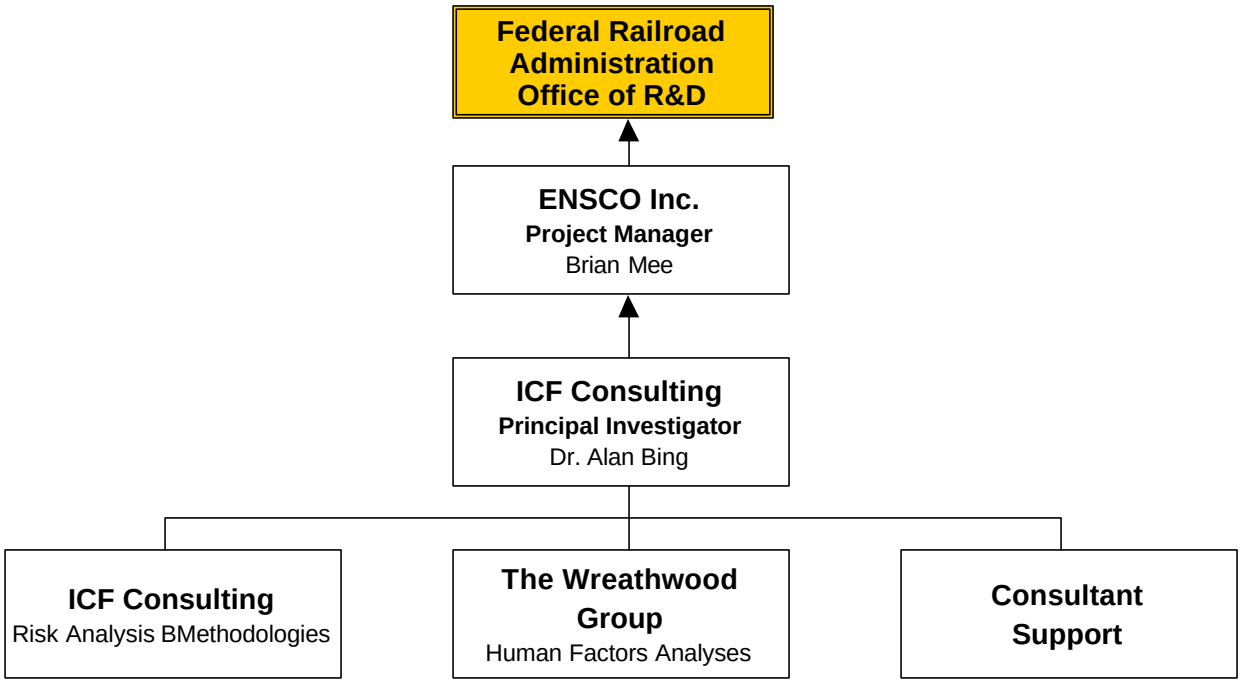
Work Plan – Analysis of PTC Systems (Task 4)

The risk models for each PTC system will be exercised for several analysis cases

- A base case representing the corridor before installation of the PTC.
- A case representing “perfect” performance of the PTC system: given system capabilities, assumes all potentially preventable accidents are prevented.
- A case representing the best estimate of actual PTC safety performance, incorporating expected mechanical, electronic and human failures.
- A few sensitivity and other cases, depending on the nature of the system and confidence in model input parameters.

Project Team

A broadly-skilled project team has been assembled for this project.



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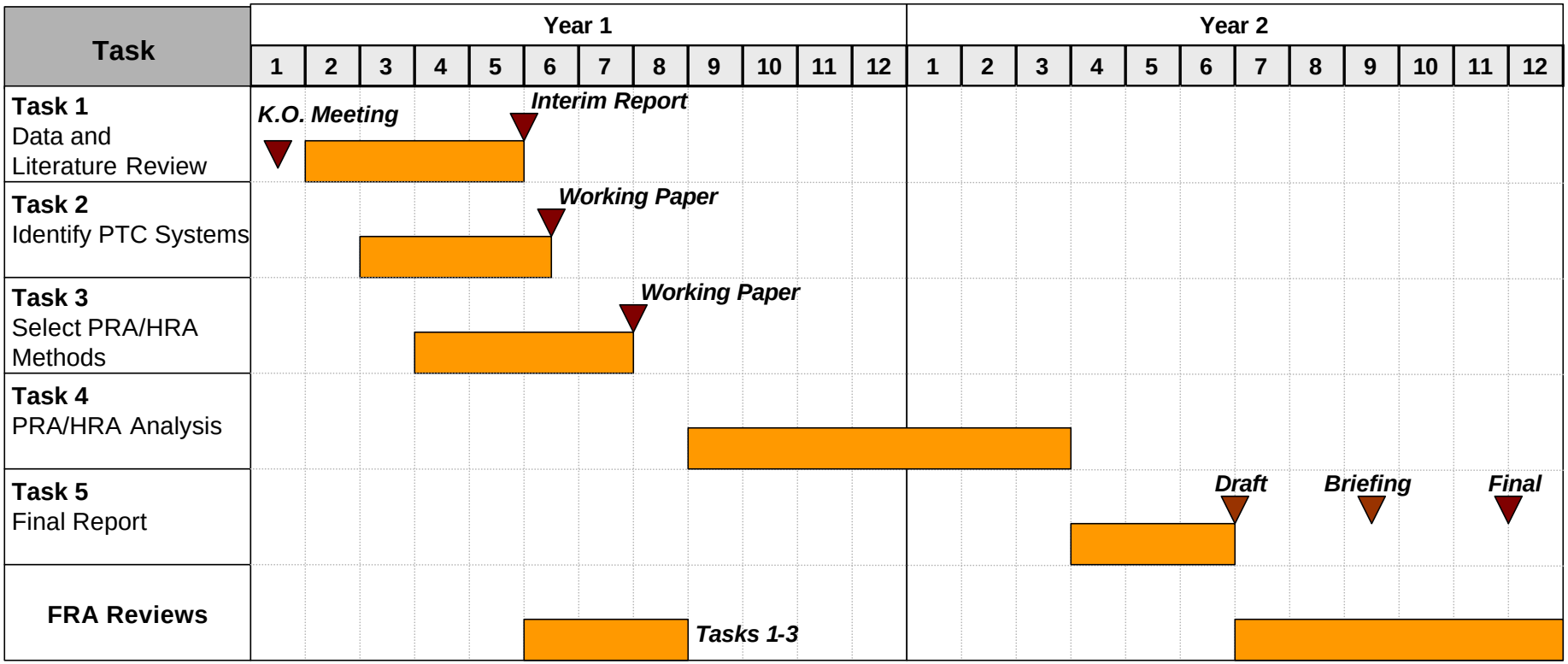
Schedule

The goal is to take approximately 15 months to complete the analysis, followed by reporting and reviews.



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